NZPQA

New Zealand Pretend Qualifications Authority

Level 2 Chemistry

91164 (2.4): Demonstrate understanding of bonding, structure, properties and energy changes.

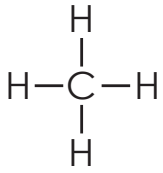
For Assessor's use only	Achievement Criteria	
Achievement	**Achievement with Merit**	**Achievement with Excellence**
Demonstrate understanding of bonding, structure, properties and energy changes. ☐	Demonstrate in-depth understanding of bonding, structure, properties and energy changes. ☐	Demonstrate comprehensive understanding of bonding, structure, properties and energy changes. ☐
Overall Level of Performance ☐		

QUESTION ONE: BONDING, STRUCTURE AND PROPERTIES.

1. Sodium bromide (NaBr) has a melting point of 770 °C. In terms of the structure and bonding within the compound, explain why it has such a **high melting point**.

2. Sodium bromide (NaBr) is **soluble** in water (90 g / 100 mL). Discuss sodium bromide dissolving in water in terms of the structure and bonding of the solute and solvent.

3. (a) Lewis structures for two molecules are given below.

Molecule	H_2S	CH_4
Lewis diagram		

For each molecule, name the shape of the molecule and give a reason for your answer.

H_2S Shape: _____

Reason:

CH_4 Shape: _____

Reason:

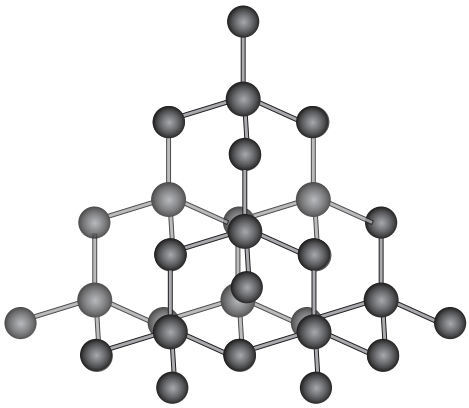
(b) State the polarity of each of these molecules.

(i) H_2S **Polar** **Non-polar**

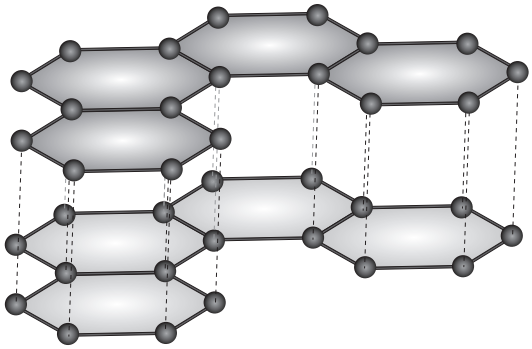
(ii) CH_4 **Polar** **Non-polar**

(c) For each molecule, give a justification for your choice.

4. The diagrams below show 3-D structural representations of diamond and graphite. Diamond and graphite are both made up of carbon atoms, but these atoms are arranged differently in each solid.



Structure of diamond



Structure of graphite

(a) Describe the electrical conductivity and hardness of diamond and graphite.

Diamond

Electrical conductivity: _____

Hardness: _____

Graphite

Electrical conductivity: _____

Hardness: _____

(b) Discuss the electrical conductivity and hardness of both diamond and graphite, using your knowledge of structure and bonding.

QUESTION TWO: ENERGY CHANGES

1. Classify the following reactions, by writing in the box below the word '**Exothermic**' or '**Endothermic**'.

	Exothermic or Endothermic
$C_2H_{4(g)} + H_2O_{(g)} \longrightarrow C_2H_5OH_{(g)} \quad \Delta_rH = -48.0 \text{ kJ mol}^{-1}$	
$H_2O_{(g)} \longrightarrow H_2O_{(l)}$	
$CH_{4(g)} + H_2O_{(g)} \longrightarrow CO_{(g)} + 3H_{2(g)}$ 206 kJ of energy is absorbed.	
When zinc powder reacts with copper sulfate solution, the temperature rises.	

2. When a 12.2 g sample of ammonia is burned, 275 kJ of energy is released.

Calculate the energy released for the reaction below, when four moles of ammonia are burned.

$$4NH_{3(g)} + 3O_{2(g)} \longrightarrow 2N_{2(g)} + 6H_2O_{(l)}$$

$$M(NH_3) = 17.0 \text{ g mol}^{-1}$$

3. Methane reacts with oxygen according to the following reaction:

$$CH_{4(g)} + 2O_{2\,(g)} \longrightarrow CO_{2\,(g)} + 2H_2O_{(g)}$$

Use the following bond enthalpies to calculate the Δ_rH for this reaction:

Bond	**Bond enthalpy (kJ mol^{-1})**
O-H	463
O=C	745
O=O	498
C-H	412